

# General Specifications

## Model CA51/CA71 HANDY CAL calibrator

GS 77W02A01-01-E

### ■ GENERAL

The CA51/CA71 HANDY CAL calibrators are comprehensive generating/measuring instruments for all your calibration and equipment checking needs at maintenance sites. The CA51/CA71 can simultaneously generate and measure voltage, current, TC, RTD and pulse signals, thus you don't need to prepare many instruments. In addition, the incorporated rotary switches of good reputation enable operations so smooth that an incorrect measurement caused from erroneous operations can be prevented.

### ■ FEATURES

#### Simultaneous signal generation and measurement capability

The CA71 lets you handle regular tests on TCs, RTDs and various other types of sensors and instruments, as well as operation checks when a problem has occurred. By itself it can generate signals for input to equipment, and check output signal from equipment.

(TC and RTD measurement functions: CA71 only)

#### AC voltage (including supply voltage) measurement capability

In cases where numerous signal converters and other devices are mounted on a rack or panel, the CA51/CA71 can be used to check the input and output signals of each device, while simultaneously checking the power supply. There is no need for a separate multimeter to measure supply voltage.

#### A wide array of useful functions

Divided output (n/m) function, Auto-step function, Sweep function, Memory function and Communication function are available.

(Communication function: CA71 only)

#### Easy Operation

The CA51/CA71 incorporates rotary switches for simple handling. Just open the cover of carrying case and connect the cables, and you are ready to take measurement.

### ■ FUNCTIONS

#### Generation and Measurement

##### Generation and Measurement of Voltage/Current

The CA51/CA71 can generate voltage/current up to 30 V DC/24 mA DC and measure up to 100 V DC/100 mA DC.

##### 4-20 mA Step Function

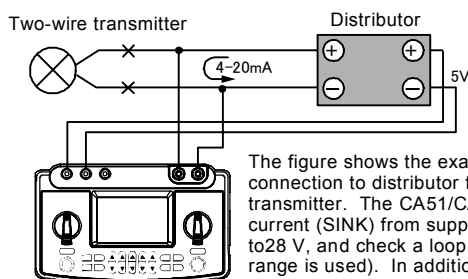
You can set the signal in 4 mA increments or decrements in order  $4 \rightleftharpoons 8 \rightleftharpoons 12 \rightleftharpoons 16 \rightleftharpoons 20$  mA by one touch operation.

##### 20 mA SINK Function

The 20 mA SINK function can draw current from an external voltage source to the H terminal of SOURCE unit. Thus, the CA51/CA71 can be used in a loop test, for example, as a simulator for transmitters.



#### Example of Connection



The figure shows the example of connection to distributor for two-wire transmitter. The CA51/CA71 can draw current (SINK) from supply voltage up to 28 V, and check a loop (20 mA SINK range is used). In addition, it can simultaneously measure the output of distributor.

#### Equivalent Output of TC/RTD

In addition to 10 types of TC (K, E, J, T, N, L, U, R, S and B), RTD (Pt100, JPt100) outputs are available.

The CA51/CA71 can be used for maintenance of industrial instruments for process or various thermometers.

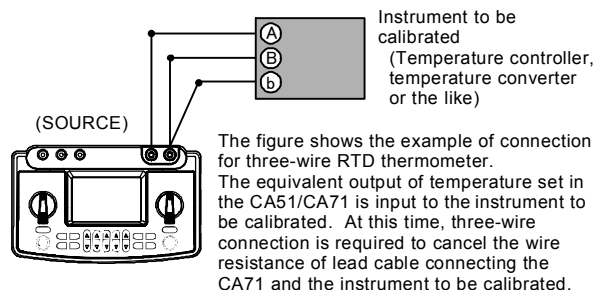
#### Multi Temperature

The CA51/CA71 can be used as multi thermometer because the measurements for all ranges are available. For RTD, 3-wire measurement is available.

#### Built-in Reference Junction Compensation Sensor

As a means of easily providing reference junction compensation when TC is generated, you can use the temperature sensor within the CA51/CA71. For more accurate reference junction compensation, use RJ sensor (model: B9108WA) sold separately.

#### Example of Connection



The figure shows the example of connection for three-wire RTD thermometer. The equivalent output of temperature set in the CA51/CA71 is input to the instrument to be calibrated. At this time, three-wire connection is required to cancel the wire resistance of lead cable connecting the CA71 and the instrument to be calibrated.

### Generation and Measurement of Pulse

Frequency can be set in the wide range of 1 Hz to 11 kHz.

With switch selection, the CA51/CA71 can generate or measure pulses.

It is suitable for checking a flow meter or receiver.

### Generation and Measurement of Voltage Pulse and Contact Pulse

The CA51/CA71 can generate and measure voltage pulse (amplitude: +0.1 V to +15 V, zero base waveform) and contact pulse.

### Pulse Cycle Function

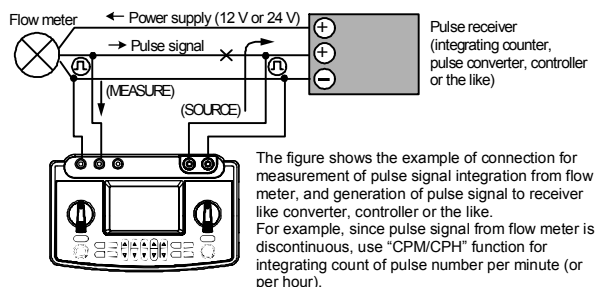
The set pulse can be output. It is suitable for checking integrating counter. (Any value of frequency and amplitude is settable.)

### CPM (count/min), CPH (count/hour) Function

In MEASURE mod (functions for measurement), pulse number per minute is counted. It is suitable for the integration of discontinuous pulse signals from flow meter.

In SOURCE mode (functions for generation), you can select either generation of continuous pulse signals or generation of given number of pulses.

### Example of Connection



### Measurement of Commercial Power Supply Voltage

AC voltage up to 300 V can be measured. World-wide supply voltage can also be measured.

### Useful Functions

#### Divided Output (n/m) Function

The divided output (n/m) function outputs a value n/m times the setpoint of a voltage, current, resistance, TC or RTD signal.

When inputting the percentage of instrument input value within the range of zero to full scale, bothersome calculations for percentage is not required..

#### Auto Step Function

The auto-step function divides the range of zero to full scale into m equally, increases or decreases the output in a step-by-step manner by changing the variable n of the n/m output from n=0 to m when the divided output function (n/m) is selected.

#### Sweep Function

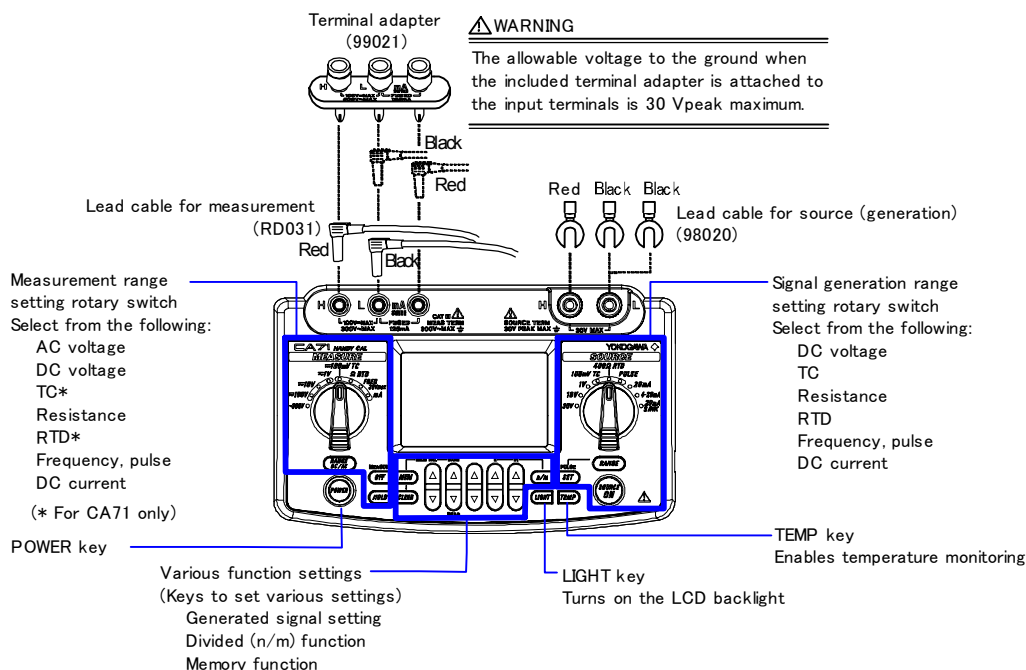
The sweep function linearly increases or decreases the output.

#### Memory Function

With a pair of generated and measured signal values in a set, the CA51/CA71 can handle a maximum of 50 sets of data by means of its built-in memory.

#### Communication Function (CA71 only)

By connecting the communication cable (RS-232): 91017, you can read internal memory data and measured value, or set the generated signal from a personal computer.



## SPECIFICATIONS

### SOURCE unit: Range and Accuracy

Accuracy:  $\pm$ (setting percentage plus  $\mu$ V, mV, mA,  $\Omega$  or  $^{\circ}$ C)

| Parameter        | Reference      | Range               | Accuracy (23±5 °C per year)                                                     | Resolution                                                                      | Remarks                                                                                                                                                                                                              |      |
|------------------|----------------|---------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| DC voltage       | 100mV          | -10.00 to 110.00 mV | ± (0.02%+15 μV)                                                                 | 10 μV                                                                           |                                                                                                                                                                                                                      |      |
|                  | 1 V            | 0 to 1.1000 V       | ± (0.02%+0.1 mV)                                                                | 0.1 mV                                                                          | Maximum output: 5 mA                                                                                                                                                                                                 |      |
|                  | 10 V           | 0 to 11.000 V       | ± (0.02%+1 mV)                                                                  | 1 mV                                                                            | Maximum output: 10 mA                                                                                                                                                                                                |      |
|                  | 30 V           | 0 to 30.00 V        | ± (0.02%+10 mV)                                                                 | 10 mV                                                                           | Maximum output 10 mA *1                                                                                                                                                                                              |      |
| DC current       | 20 mA          | 0 to 24.000 mA      | ± (0.025%+3 μA)                                                                 | 1 μA                                                                            | Maximum load: 12 V                                                                                                                                                                                                   |      |
|                  | 4-20 mA        | 4/8/12/16/20 mA     |                                                                                 | 4 mA                                                                            |                                                                                                                                                                                                                      |      |
| mA SINK          | 20 mA          | 0.1 to 24.000 mA    | ± (0.05%+3 μA)                                                                  | 1 μA                                                                            | External power supply: 5 to 28 V                                                                                                                                                                                     |      |
| Resistance       | 400 Ω          | 0 to 400.00 Ω       | ± (0.025%+0.1 Ω)                                                                | 0.01 Ω                                                                          | Excitation current: 0.5 to 5 mA *3                                                                                                                                                                                   |      |
| RTD              | Pt100 *2       | -200.0 to 850.0 °C  | ± (0.025%+0.3 °C)                                                               | 0.1 °C                                                                          | If 0.1 mA, add 0.25 Ω or 0.6°C. Subject device input capacitance: 0.1 μF or less                                                                                                                                     |      |
|                  | JPt100         | -200.0 to 500.0 °C  |                                                                                 |                                                                                 |                                                                                                                                                                                                                      |      |
| TC *4            | K              | -200.0 to 1372.0 °C | ± (0.02%+0.5 °C)<br>(-100 °C or greater)<br>± (0.02%+1 °C)<br>(-100 °C or less) | 0.1 °C                                                                          | TC generation accuracy does not include RJ sensor accuracy.<br>< RJ sensor specs ><br>Measurement range: -10 to 50 °C<br>Accuracy (when combined with main unit)<br>18 to 28°C: ±0.5°C<br>Other than the above: ±1°C |      |
|                  | E              | -200.0 to 1000.0 °C |                                                                                 |                                                                                 |                                                                                                                                                                                                                      |      |
|                  | J              | -200.0 to 1200.0 °C |                                                                                 |                                                                                 |                                                                                                                                                                                                                      |      |
|                  | T              | -200.0 to 400.0 °C  |                                                                                 |                                                                                 |                                                                                                                                                                                                                      |      |
|                  | N              | -200.0 to 1300.0 °C |                                                                                 |                                                                                 |                                                                                                                                                                                                                      |      |
|                  | L              | -200.0 to 900.0 °C  |                                                                                 |                                                                                 |                                                                                                                                                                                                                      |      |
|                  | U              | -200.0 to 400.0 °C  | ± (0.02%+1 °C)<br>(0 °C or less)                                                |                                                                                 |                                                                                                                                                                                                                      |      |
|                  | R              | 0 to 1768 °C        |                                                                                 | ± (0.02%+2.5 °C)<br>(100 °C or less)                                            |                                                                                                                                                                                                                      | 1 °C |
|                  | S              |                     |                                                                                 | ± (0.02%+1.5 °C)<br>(100 °C or greater)                                         |                                                                                                                                                                                                                      |      |
|                  | B              | 600 to 1800 °C      |                                                                                 | ± (0.02%+2 °C)<br>(1000 °C or less)<br>± (0.02%+1.5 °C)<br>(1000 °C or greater) |                                                                                                                                                                                                                      |      |
| Frequency, pulse | 500 Hz         | 1.0 to 500.0 Hz     | ± 0.2 Hz                                                                        | 0.1 Hz                                                                          | Output voltage: +0.1 to 15 V (zero base waveform)                                                                                                                                                                    |      |
|                  | 1000 Hz        | 90 to 1100 Hz       | ± 1 Hz                                                                          | 1 Hz                                                                            | Amplitude accuracy: ±(5% + 0.1 V)                                                                                                                                                                                    |      |
|                  | 10 kHz         | 0.9 kHz to 11.0 kHz | ± 0.1 kHz                                                                       | 0.1 kHz                                                                         | Maximum load current: 10 mA                                                                                                                                                                                          |      |
|                  | Pulse cycle *5 | 1 to 99999 cycles   | —                                                                               | 1 cycles                                                                        | Contact output<br>(With 0.0 V amplitude setting, FET switch ON/OFF)<br>Maximum open/close voltage/current: +28 V/50 mA                                                                                               |      |

Temperature coefficient: Accuracy shown above  $\times$  (1/5)  $^{\circ}$ C

\*1: Output up to 24 V/22 mA is possible when using the AC adapter.

\*2: As per JIS C 1604-1997 (ITS-90). IPTS-68 may be selected through internal settings (DIP switch).

\*3: Excitation current: If less than 0.1 mA to 0.5 mA, then add [0.025/Is (mA)] $\Omega$  or [0.06/Is (mA)]  $^{\circ}$ C

\*4: As per JIS C 1602-1995 (ITS-90) (L and U are DIN specs).

K, E, J, T, N, R, S, and B may be switched to IPTS-68 through internal settings (DIP switch) (L and U are not switched).

\*5: Frequency (interval between one pulse and another) and amplitude during pulse cycle generation may have the same range as during frequency generation.

### MEASURE unit: Range and Accuracy

Accuracy:  $\pm$ (reading percentage plus  $\mu$ V, mV,  $\mu$ A,  $\Omega$  or dgt (digit))

| Parameter        | Reference    | Range                | Accuracy (23 $\pm$ 5 $^{\circ}$ C per year) | Resolution    | Remarks                                                 |
|------------------|--------------|----------------------|---------------------------------------------|---------------|---------------------------------------------------------|
| DC voltage       | 100 mV       | 0 to $\pm$ 110.00 mV | $\pm$ (0.025% + 20 $\mu$ V)                 | 10 $\mu$ V    | Input resistance: 10 M $\Omega$ or greater              |
|                  | 1 V          | 0 to $\pm$ 1.1000 V  | $\pm$ (0.025% + 0.2 mV)                     | 0.1 mV        |                                                         |
|                  | 10 V         | 0 to $\pm$ 11.000 V  | $\pm$ (0.025% + 2 mV)                       | 1 mV          | Input resistance: Approximately 1 M $\Omega$            |
|                  | 100 V        | 0 to $\pm$ 110.00 V  | $\pm$ (0.05% + 20 mV)                       | 0.01 V        |                                                         |
| DC current       | 20 mA        | 0 to $\pm$ 24.000 mA | $\pm$ (0.025% + 4 $\mu$ A)                  | 1 $\mu$ A     | Input resistance: Approximately 14 $\Omega$             |
|                  | 100 mA       | 0 to $\pm$ 100.00 mA | $\pm$ (0.04% + 30 $\mu$ A)                  | 10 $\mu$ A    |                                                         |
| Resistance       | 400 $\Omega$ | 0 to 400.00 $\Omega$ | $\pm$ (0.05% + 0.1 $\Omega$ )               | 0.01 $\Omega$ | Accuracy during 3-wire measurement                      |
| AC voltage       | 1 V          | 0 to 1.100 V         | $\pm$ (0.5% + 5 dgt)                        | 1 mV          | Input resistance:                                       |
|                  | 10 V         | 0 to 11.00 V         |                                             | 0.01 V        | Approximately 10 M $\Omega$ //10 pF                     |
|                  | 100 V        | 0 to 110.0 V         |                                             | 0.1 V         | Input resistance:                                       |
|                  | 300 V        | 0 to 300 V           | $\pm$ (0.5% + 2 dgt)                        | 1 V           | Approximately 1 M $\Omega$ //10 pF                      |
| Frequency, pulse | 100 Hz       | 1.00 to 100.00 Hz    | $\pm$ 2 dgt                                 | 0.01 Hz       | Maximum input: 30 V peak                                |
|                  | 1000 Hz      | 1.0 to 1000.0 Hz     |                                             | 0.1 Hz        | Input resistance: 200 k $\Omega$ or greater             |
|                  | 10 kHz       | 0.001 to 11.000 kHz  |                                             | 0.001 kHz     | Sensitivity: 0.5 V peak or greater                      |
|                  | CPM          | 1 to 99999 CPM       |                                             | 1 CPM         | Contact input: Maximum 100Hz                            |
|                  | CPH          | 1 to 99999 CPH       |                                             | 1 CPH         | Notes<br>CPM: Counts per minute<br>CPH: Counts per hour |

Temperature coefficient: Accuracy shown above  $\times$  (1/5)  $^{\circ}$ C

**MEASURE unit (temperature): Range and Accuracy (CA71 only)**Accuracy:  $\pm$ (reading percentage plus  $^{\circ}\text{C}$ )

| Parameter |          |                | Reference           | Range                                                                           | Accuracy (23±5 °C per year) | Resolution                         | Remarks |
|-----------|----------|----------------|---------------------|---------------------------------------------------------------------------------|-----------------------------|------------------------------------|---------|
| TC *7     | K        |                | -200.0 to 1372.0 °C | ± (0.05% + 1.5 °C)<br>(-100 °C or greater)                                      | 0.1 °C                      |                                    |         |
|           | E        |                | -200.0 to 1000.0 °C |                                                                                 |                             |                                    |         |
|           | J        |                | -200.0 to 1200.0 °C |                                                                                 |                             |                                    |         |
|           | T        |                | -200.0 to 400.0 °C  |                                                                                 |                             |                                    |         |
|           | N        |                | -200.0 to 1300.0 °C | ± (0.05% + 2 °C)<br>(-100 °C or less)                                           | 1 °C                        |                                    |         |
|           | L        |                | -200.0 to 900.0 °C  |                                                                                 |                             |                                    |         |
|           | U        |                | -200.0 to 400.0 °C  |                                                                                 |                             |                                    |         |
|           | R        |                | 0 to 1768 °C        | ± (0.05% + 2 °C)<br>(100 °C or greater)<br>± (0.05% + 3 °C)<br>(100 °C or less) | 1 °C                        |                                    |         |
|           | S        |                | 0 to 1768 °C        |                                                                                 |                             |                                    |         |
| B         |          | 600 to 1800 °C |                     |                                                                                 |                             |                                    |         |
| RTD       | Pt100 *6 |                | -200.0 to 850.0 °C  | ± (0.05% + 6 °C)                                                                | 0.1 °C                      | Accuracy during 3-wire measurement |         |
|           | JPt100   |                | -200.0 to 500.0 °C  |                                                                                 |                             |                                    |         |

Temperature coefficient: Accuracy shown above  $\times (1/5)^{\circ}\text{C}$ 

\*6: As per JIS C 1604-1997 (ITS-90). IPTS-68 may be selected through internal settings (DIP switch).

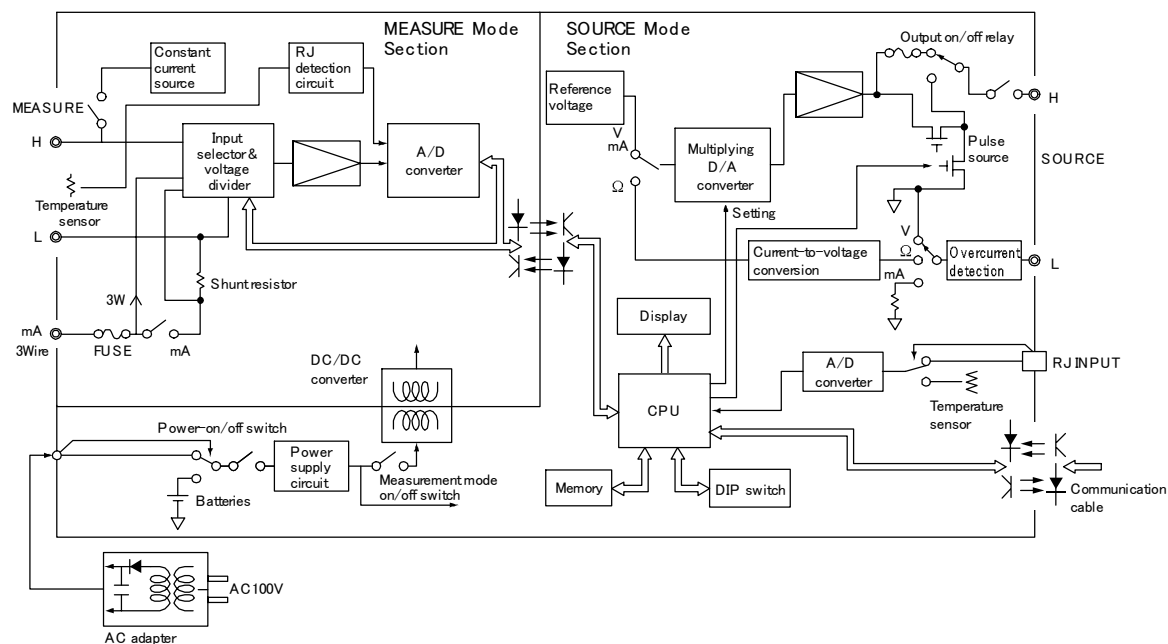
\*7: As per JIS C 1602-1995 (ITS-90) (L and U are DIN specs).

K, E, J, T, N, R, S, and B may be switched to IPTS-68 through internal settings (DIP switch) (L and U are not switched).

**General Specifications**

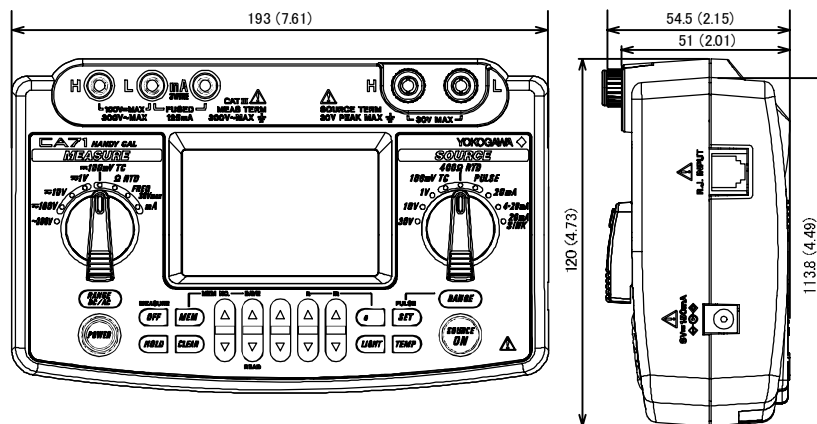
| Parameter                                 |                 |          | Specification                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------|-----------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SOURCE unit response time                 |                 |          | Approximately 1 second (time between start of voltage change and when voltage enters accuracy range)                                                                                                                                                                                                                                 |
| SOURCE unit voltage limiter               |                 |          | Approximately 32 V                                                                                                                                                                                                                                                                                                                   |
| SOURCE unit current limiter               |                 |          | Approximately 25 mA                                                                                                                                                                                                                                                                                                                  |
| Divided output (n/m) function             |                 |          | Output = setting $\times$ (n/m) n= 0 to m; m = 1 to 19; n $\leq$ m                                                                                                                                                                                                                                                                   |
| Auto-step output function                 |                 |          | n value sent automatically when n/m function is selected (two options: approximately 2.5 seconds/step or approximately 5 seconds/step)                                                                                                                                                                                               |
| Sweep function                            |                 |          | Sweep time (two options: approximately 16 seconds or approximately 32 seconds)                                                                                                                                                                                                                                                       |
| Memory function                           |                 |          | 50 sets of data (generated and measured values are stored as value sets with the same address (up to 50 sets of data can be stored))                                                                                                                                                                                                 |
| MEASURE unit maximum input                |                 |          | Voltage terminal: 300V DC/AC<br>Current terminal: 120 mA DC                                                                                                                                                                                                                                                                          |
| Current terminal input protection         |                 |          | Fuses: 125 mA/250 V                                                                                                                                                                                                                                                                                                                  |
| MEASURE unit ground voltage               |                 |          | Maximum 300 V AC                                                                                                                                                                                                                                                                                                                     |
| Measurement display updating rate         |                 |          | Approximately once per second                                                                                                                                                                                                                                                                                                        |
| Serial interface                          |                 |          | Enables when communication cable (RS-232) is connected; sold separately as optional accessory (CA71 only)                                                                                                                                                                                                                            |
| Display                                   |                 |          | Segment LCD (approximately 76 mm $\times$ 48 mm)                                                                                                                                                                                                                                                                                     |
| Backlight                                 |                 |          | LED backlight; auto-off after one minute (from when LIGHT key is turned on)                                                                                                                                                                                                                                                          |
| Power supply                              |                 |          | Four AA-size (LR6) alkaline batteries, or special AC adapter (sold separately)                                                                                                                                                                                                                                                       |
| Battery life                              |                 |          | Measurement off, output 5 V DC/10 k $\Omega$ or greater: Approximately 40 hours<br>Simultaneous signal generation/measurement, output 5 V DC/10 k $\Omega$ or greater: Approximately 20 hours<br>Simultaneous signal generation/measurement, output 20 mA/5 V: Approximately 12 hours (using alkaline batteries, with backlight off) |
| Consumed power                            |                 |          | Approximately 7 VA (using 100 V AC adapter)                                                                                                                                                                                                                                                                                          |
| Auto-power-off function                   |                 |          | Approximately 10 minutes (auto-power-off can be disabled through a DIP switch setting)                                                                                                                                                                                                                                               |
| Applicable standards                      | Standard safety |          | IEC61010-1, EN61010-2-031                                                                                                                                                                                                                                                                                                            |
|                                           | EMC             | Emission | EN61236-1 Class B, EN61000-3-2, EN61000-3-3<br>EN55011: Group1, Class                                                                                                                                                                                                                                                                |
|                                           |                 | Immunity | EN61326 Annex B                                                                                                                                                                                                                                                                                                                      |
| Insulation resistance                     |                 |          | Across input terminal and output terminal, 500V DC, 50 M $\Omega$ or greater                                                                                                                                                                                                                                                         |
| Withstand voltage                         |                 |          | Across input terminal and output terminal, 3.7 kV AC, for one minute                                                                                                                                                                                                                                                                 |
| Operating temperature and humidity ranges |                 |          | 0 to 50 $^{\circ}$ C, 20 to 80% RH (no condensation)                                                                                                                                                                                                                                                                                 |
| Storage temperature and humidity ranges   |                 |          | -20 to 50 $^{\circ}$ C, 90% RH or less (no condensation)                                                                                                                                                                                                                                                                             |
| External dimensions (WHD)                 |                 |          | Approximately 190 $\times$ 120 $\times$ 55 mm                                                                                                                                                                                                                                                                                        |
| Wight                                     |                 |          | Approximately 730 g (including batteries)                                                                                                                                                                                                                                                                                            |

## HARDWARE BLOCK DIAGRAM



## EXTERNAL DEMENSIONS

Unit: mm  
(approx. inches)



Note: This figure shows the CA71, but there is no difference in exterior from the CA51.

## ■ MODEL

| Model | Name                      | Remarks                                                           |
|-------|---------------------------|-------------------------------------------------------------------|
| CA51  | CA51 HANDY CAL calibrator | Basic model                                                       |
| CA71  | CA71 HANDY CAL calibrator | Provided with temperature measurement and communication functions |

### Standard accessories:

Lead cables for source (generation) (one red, two black): 98020

Lead cables for measurement (one red, one black): RD031

Carrying case: 93016

Terminal adapter: 99021

User's manual: IM CA71-E

Fuse: A1501EF for current terminal input protection

Four AA-size (LR6) alkaline batteries: A1070EB × 4

## ■ ORDERING INSTRUCTIONS

When ordering, specify the model and necessary/unnecessary of QIC.

## ■ OPTIONAL ACCESSORIES AND SPARE PARTS

### Optional Accessories

| Model   | Product             | Remarks                                           |
|---------|---------------------|---------------------------------------------------|
| A1020UP | AC adapter          | AC adapter for 100 V AC power supply              |
| A1022UP | AC adapter          | AC adapter for 120V AC power supply               |
| B9108WB | AC adapter          | AC adapter for 220 to 240 V AC power supply       |
| B9108WA | RJ sensor           | Sensor for reference junction compensation        |
| B9108XA | Accessories case    | Lead cable, RJ sensor and the like can be stored. |
| 91017   | Communication cable | 9-pin D-sub                                       |

### Spare Parts

| Model   | Product                             | Remarks                                                                                                                                     |
|---------|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 98020   | Lead cables for source (generation) | One red, two black                                                                                                                          |
| RD031   | Lead cables for measurement         | One red, one black                                                                                                                          |
| 93016   | Carrying case                       | Lead cables for source (generation)/measurement, terminal adapter, four spare batteries, fuse, AC adapter and User's manuals can be stored. |
| 99021   | Terminal adapter                    | Used when measuring temperatures                                                                                                            |
| A1501EF | Fuse                                | For current terminal input protection (sold by the ten pieces)                                                                              |